PHASE I ENVIRONMENTAL SITE ASSESSMENT AND GEOTECHNICAL STUDY

PROPOSED BOILER ADDITION & PARKING LOT
SALT LAKE COMMUNITY COLLEGE
SOUTH CITY CAMPUS
SALT LAKE CITY, UTAH

Prepared For:

STATE OF UTAH, DEPARTMENT OF ADMINISTRATIVE SERVICES

DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT

4110 STATE OFFICE BUILDING

SALT LAKE CITY, UTAH 84114

JOB NO. 3059.

JUNE 1, 1993

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June 1, 1993

Mr. Ben Hutchinson, Project Coordinator
State of Utah, Department of Administrative Services
Division of Facilities Construction and Management
4110 State Office Building
Salt Lake City, Utah

Dear Mr. Hutchinson:

We have completed our Phase I Environmental Site Assessment and Geotechnical Study for the proposed boiler addition at the Salt Lake Community College, South City Campus, in Salt Lake City, Utah. Details of our findings and recommendations, along with the supporting field and laboratory data, are presented in the attached report. The study was conducted at your request in accordance with our Proposal No. P-765 dated May 16, 1993.

Five test holes were drilled at this site. The subsoils generally consist of loose sands and silts underlain by soft, compressible clays extending to the maximum depths explored. Groundwater was encountered at depths ranging from 10 to 12.5 feet. Subsurface samples from Test Holes 4 and 5 showed no indications of contamination from the two existing USTs at the boiler plant.

The site is suitable for the proposed boiler addition if the recommendations of this report are properly implemented during design and construction. Spread footings founded on a minimum of 4 feet of granular structural fill are recommended for foundation support. Stabilization of the soft native soils will be required. The footings can be proportioned for a net allowable soil bearing pressure of up to 1,500 psf.

The proposed parking addition encountered similar soils which were overly wet due to watering of the existing grass field. Stabilization would also be required in the parking area if moisture contents of the soils are not significantly reduced.

We appreciate the opportunity to be of service to you on this project. Please call us if you have any questions or need additional information.

Very truly yours,

DELTA GEOTECHNICAL CONSULTANTS, INC.

HOVIK BAGHOOMIAN, P.E., Ph.D.
President

HB/amh
Submitted in Three Copies

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INTRODUCTION

This report presents the results of our environmental site assessment and geotechnical study conducted at the site of the proposed boiler plant addition at the Salt Lake Community College, South City Campus in Salt Lake City, Utah. The objective of the site assessment was to determine if past or current use of the existing boiler plant may have caused any real or potential liabilities for its future owners. The purpose of our geotechnical study was to provide information on subsoil and groundwater conditions, recommendations for foundation types and depths, soil bearing capacities, anticipated total and differential settlement, pavement design, and other design and construction considerations influenced by the subsoil conditions.

The scope of services, site assessment procedures, findings, conclusions and recommendations are presented in the following pages.

The general location of the site is shown on the Vicinity Map, Figure A-1, presented in Appendix A.

SCOPE OF SERVICES

The scope of our services consisted of the following:

- Review of aerial photographs and published maps to determine historic land use
- Research of city, county, state and federal records to evaluate the possible presence of hazardous substances on or near the property
- Interviews of neighbors to verify and expand on data collected from the sources discussed above

- Inspection of the site and accessible neighborhood facilities to evaluate their present condition, with emphasis on environmental issues such as:
  - Underground storage tanks
  - Storage, use, and disposal of hazardous substances
  - Refuse handling and landfills, and surface and underground drainage
- Search of U.S. Environmental Protection Agency (EPA), Utah Department of Environmental Quality (UDEQ), and other applicable regulatory agency records for permits, tank registrations, citations, penalties, and noncompliance
- Identification of equipment containing possible polychlorinated biphenyls (PCBs)
- Visual inspection of soil samples recovered during the subsurface exploration
- The geotechnical study included site reconnaissance, subsurface exploration and sampling, field and laboratory testing, engineering analysis, client consultation, and preparation of this report.

ENVIRONMENTAL SITE ASSESSMENT

SITE LOCATION AND DESCRIPTION

The study area is approximately 0.5 acres in area and is 4,255 feet above mean sea level. It is located in a moderately developed, relatively old neighborhood that has been zoned R-2 (single family residential). The study area is bordered to the north by a landscaped area, to the east by an access road, to the south by the existing boiler room, and to the west by the gymnasium.

The site has access to the following utilities:

- Sanitary sewer
- Culinary water
- Natural gas
- Electricity
- Telephone

The subject site is currently paved with asphalt and serves as a parking area. Two underground storage tanks are located under the parking lot.

REGIONAL GEOLOGY AND TOPOGRAPHY

The site is located within the Salt Lake Valley, a deep sediment-filled, structural basin flanked by two uplifted range blocks; the Wasatch Range to the east, and the Oquirrh Mountains to the west. The surficial geology is typical of post Lake Bonneville regressive-phase lacustrine, marsh, and alluvial deposits (Holocene to uppermost Pleistocene) consisting of about 3 to 10 feet of clay, silt, sand, peat, and very minor pebble gravel (Personius and Scott, 1992).

The nearest segment of the active Wasatch Fault is about 1½ miles to the east. The site is located within an area where the soils are rated as having a high liquefaction potential (Nelson, 1989).

The topography of the site is relatively flat, with a slight regional slope to the west.

SITE HYDROLOGY

The subsurface hydrology consists of two aquifers: a shallow unconfined aquifer and a deeper, confined aquifer. The depth to the unconfined aquifer varies somewhat based on climatic

cycles and seasonal fluctuations, but is expected to be on the order of 10 to 15 feet and contains 1,000 to 2,000 mg/l total dissolved solids (Seiler and Waddell, 1984). The deeper, confined aquifer, known as the principal aquifer, generally meets the standards for public drinking water supply (Waddell, Seiler, and Solomon, 1987). The direction of groundwater flow is generally west toward the Jordan River, which is located about two miles to the west.

The Utah Division of Water Rights, Water Rights Points of Diversion Plot, created May 19, 1993, (Figure C-1) lists 402 points of diversion (1 for municipal use) within a one-mile radius of the property.

The National Oceanic and Atmospheric Administration reports that the average yearly rainfall for the area is about 15 inches.

REVIEW OF HISTORICAL RECORDS

Historical aerial photographs available at the U.S. Department of Agriculture Aerial Photography Field Office in Salt Lake City were viewed as part of the site assessment. These included:

Photograph	Date
AAL-4K-123	September 1, 1952
AAL-12V-74	May 27, 1958
AAL-1FF-113	June 1, 1965
AAL-1MM-20	October 7, 1971
49035-177-73	June 28, 1977
NAPP 325-36	September 21, 1987

The photograph taken in 1952 showed that South High School had been constructed, but

consisted of considerably fewer buildings than are currently located on the property. A track and field facility was under construction.

The only change noted in the 1958 photograph was that one additional building had been built on the school grounds. No significant changes were observed in the 1965, 1971 or 1977 photographs.

The photograph taken in 1987 showed the site much as it appears today. The boiler room and gymnasium, as well tennis courts were clearly visible.

In summary, the review of historical aerial photographs of the area indicates that portions of the South High School were constructed prior to 1952. No significant environmental problems were identified during the review.

U.S. Geological Survey topographical maps were also reviewed, and topographic features identified. Nothing unusual could be identified from these maps (Figure A-1).

Agency Records

The registered underground storage tank (UST) list and five other databases of hazardous waste site locations in the vicinity are available at the Utah Department of Environmental Quality, and were reviewed as part of our site assessment. These databases include:

- Leaking underground storage tank list (LUST)
- Comprehensive Environmental Response, Compensation and Liability Act, or "Superfund", list (CERCLIS)
- National Priority List (NPL)
- Municipal/commercial/private landfills
- Resource Conservation and Recovery Act list (RCRA)

Registered Underground Storage Tank List

According to the Utah Underground Storage Tank (UST) list, there are no USTs registered for the subject property. Two unregistered USTs are located on the site. The USTs are exempt from registration because they contain #2 diesel fuel for use on the premises (in the boiler). The USTs are 10,000 and 20,000 gallons in capacity respectively, and were installed in the 1960's. We understand that plans are being formulated to remove the USTs.

Subsurface samples taken from Test Holes 4 and 5 near the existing tanks showed no visible signs of contamination from petroleum hydrocarbons.

Leaking Underground Storage Tank List (LUST)

According to the LUST List dated April 15, 1993, there are 28 confirmed LUST sites within a mile radius of the subject site. The nearest listed LUST site is located at Intermountain Glass, Inc. (facility number 4001567), 1530 South State Street, northwest of the subject site. The Intermountain Glass, Inc. LUST site was closed on January 23, 1990. Considering the distance separating the two sites, the closed status of the LUST site, and the regional groundwater flow direction, it is considered unlikely that known LUST sites would impact the subject property.

CERCLIS

The CERCLIS database, available at the Utah Department of Environmental Quality, has been developed by the EPA and includes the contaminated sites which are listed under the Federal Superfund program. There are 70 CERCLIS sites listed (1/15/92) for Salt Lake City (see Appendix D). None of the CERCLIS sites are within a one-half mile radius of the subject

department will be forwarded to you as an addendum to this report.

ASBESTOS CONTAINING MATERIALS (ACM)

No man-made structures are located on the subject property and therefore, an asbestos survey was considered outside our scope of work. We were informed that the existing boiler room, adjacent to the southern boundary of the subject property, was abated for asbestos in late 1988.

POLYCHLORINATED BIPHENYLS (PCBs)

No transformers or other electrical equipment suspected of containing PCBs were observed on or near the subject property.

PERSONAL INTERVIEWS

Mr.Robert L. Askerlund, Project Manger and Mr. Frank Atkinson, HVAC Supervisor, both of the Salt Lake Community College, have been associated with the site since 1988 and supplied us with the following information.

The Salt Lake Community College purchased the property from the Salt Lake School Board in 1988. The old South High portion of the school was constructed in 1933. The part of the school nearest to the study area was constructed in 1966. Two USTs were installed on the subject site in the mid 1960's. The eastern UST is 20,000 gallons in capacity and the western UST is 10,000 gallons in capacity. Both USTs contain #2 diesel. The fuel from the

storage tanks is burned in a boiler which located immediately south of the study area. The boiler was also installed in the mid 1960's. The USTs are "stuck" weekly as a measure of inventory control. It was previously discovered that the USTs were "taking on water." It was determined that the fill ports were installed too low and surface water was entering the tanks through the fill ports. The fill ports have since been raised, and the problem has ceased. No other problems with the USTs are reported.

Waste oil and gasoline USTs were removed from the auto shop portion of the campus in 1989. The auto shop is a considerable distance north of the subject site. It was reported that the removals were clean and no contamination was reported. The auto shop still utilizes a grease interceptor sump.

FIELD OBSERVATIONS

The property was visited by Mr. Bill Bymaster of Delta Geotechnical Consultants, Inc., on May 20, 1993. A visual inspection was made of the premises and adjacent facilities with emphasis on potential environmental issues. The Site Plan is included as Figure A-3 in Appendix A.

The site is paved with asphalt and currently serves as a parking lot. Adjacent to the southern boundary of the study area is the existing boiler room. The boiler room is exceptionally clean and well maintained. South of the boiler room is the chlorinating unit for the swimming pool. The following chemicals are stored and used in the chlorinating unit:

property and are not expected to negatively impact it.

National Priorities List

The National Priorities List (NPL) includes CERCLIS sites that present the greatest risk. There are fifteen NPL sites listed (1/15/92) for Utah (see Appendix D). None of the NPL sites are within a mile of the subject property.

Landfills

In addition to reviewing the hazardous waste site databases, we also obtained a list of municipal/commercial/private landfills from the Salt Lake City-County Health Department. The nearest landfill is the KCC Smelter facility which is a permitted industrial waste landfill. The facility is approximately three-quarters of a mile southwest of the subject site and is not expected to pose any environmental threats.

RCRA

The RCRA list, available at the UDEQ, Division of Solid and Hazardous Waste, identifies all businesses issued permits by EPA to generate, transport, or handle hazardous materials. There are 35 registered RCRA generators within a one-mile radius of the site. Four of the generating facilities transport hazardous materials, but none of the facilities are permitted to store, burn, or blend hazardous materials. None of the facilities are adjacent to the subject property and, given their locations, they would not be expected to pose a significant environmental threat to the subject site.

We have submitted a file search request to the Salt Lake City-County Health Department. To date we have not received a response. Any information we receive from the health

1, 5-gallon container of sodium hypochlorite

1, 5-gallon container of muriatic acid

1, 55-gallon drum of caustic soda

1, 100-pound bag of sodium bicarbonate

The chemicals are well contained and no spillage or staining was observed in the storage areas. The chemicals are used and replaced approximately every six to eight months. The Material Safety Data Sheets (MSDS) are kept on-site and are available upon request.

The following neighboring property uses were noted:

North:	-	Salt Lake Community College facilities
East:	-	parking lot
	-	Whittier Elementary School
South:	-	parking lot
West:	-	Salt Lake Community College facilities

CONCLUSIONS

Based on a review of available records, site visits, personal interviews, a surficial soil and sump sampling and analysis program, Delta concludes that:

1. The property is paved with asphalt and is currently used as a parking lot.
2. Review of historical aerial photographs suggests that the property has served as a school campus since prior to 1952.
3. Two USTs are located in the study area. The USTs contain fuel oil for use in a

boiler. The USTs are 10,000 and 20,000 gallons in capacity and are exempt from registration with the DERR.

4. Current LUST sites are not close enough to have an adverse impact on the property.

5. Because of the distances involved, the current CERCLIS, NPL, landfills, and RCRA sites are not expected to adversely impact the subject property.

6. An asbestos survey was considered outside our scope of work. We were however, informed that an asbestos abatement was conducted in the existing boiler room in 1988.

7. No transformers or other electrical equipment suspected of containing PCBs was observed on or near the study area.

8. None of the persons interviewed recalled any events of environmental significance on the subject property.

9. A limited quantity of chemicals are stored in the chlorinating unit for the swimming pool. The chemicals are well maintained.

Except for the issues stated above, the environmental liability (or threat) to an owner of this property is expected to be low.

GEOTECHNICAL RECOMMENDATIONS

PROPOSED CONSTRUCTION

We understand that a single-story addition with structural steel frame and masonry block walls is planned for construction at this site. The addition, as currently contemplated, will be approximately rectangular in shape with plan dimensions of 55 (n-s) by 63 feet (e-w). Slab-on-grade floors with no basement are anticipated for the proposed addition. The existing boiler plant contains a basement which is stepped at 6 to 11 feet below existing site grades. The south wall of the addition would be tied directly to the north wall of the existing boiler plant. Two existing USTs (discussed previously) are within the proposed addition footprint. Details are provided for backfilling the tank excavation after removal.

Anticipated wall loads are 4.0 kips per lineal foot. Maximum column loads, dead plus live, are expected to be on the order of 60 kips. The existing boiler plant has wall loads on the order of 3.3 kips per lineal foot. Additional loading on the north wall would be increased by 300 pounds per lineal foot from the boiler plant addition. Maximum anticipated floor slab loads would be 250 pounds per square foot.

A paved parking area, drive areas and concrete flatworks are also planned.

SUBSOIL CONDITIONS

Five test holes were drilled on the property. Test Holes 1, 2 and 3 were drilled in the proposed parking area and extended to depths of 16.5 feet. Test Holes 4 and 5 were drilled in the boiler addition area and were extended to a depth of 21.5 feet.

The subsoils correlated well between the test holes. An initial 12 inches of silty, clayey topsoil was encountered in the proposed pavement area. Asphalt was encountered in the building area. Below the topsoil and asphalt, to the maximum exploration depth of 21.5 feet, the subsoils generally consisted of loose silts underlain by soft, compressible clays.

For a detailed description of the conditions encountered at each test hole location, please refer to the Test Hole Logs, Figures A-4 through A-8 in Appendix A. Figure A-9 is the key to symbols and abbreviations used on the Test Hole Logs.

Groundwater was encountered at depths ranging from about 10 to 12.5 feet. Note that groundwater levels fluctuate with seasonal precipitation variations and could influence backfilling of tank excavations. We recommend that groundwater levels be checked prior to construction.

ANALYSIS AND CONCLUSIONS

The swell-consolidation test results indicate that site soils are neither expansive nor collapsible with an increase in moisture content. However, these soils do appear to be moderately to highly compressible. Thus, settlement will control the foundation design. Four (4) feet of structural fill beneath the building footings, replacing the upper compressible soils, and a minimum of 12 inches of structural fill under floor slabs, to reduce settlement, are recommended.

Please refer to Appendix B, Figure B-1, for swell-consolidation test results and Table B-I for a summary of laboratory test results.

SITE PREPARATION AND GRADING

In general the top 12 inches of topsoil, all asphalt and roadbase fill should be stripped from the proposed pavement and building areas, respectively, prior to further site grading. Localized loose areas or areas of old fill not disclosed by the test holes may require stripping in excess of 12 inches, as judged by the Geotechnical Engineer. The topsoil may be stockpiled for later use in landscaped areas (use as general fill). Asphalt cannot be used as fill at the subject site.

Following site stripping in the proposed pavement area, the subgrade should be scarified to a depth of 10 inches, allowed to dry if necessary, and recompacted to a firm, nonyielding surface prior to structural fill placement. Stabilization, if required because of overly wet native soils, is discussed under the PAVEMENT DESIGN section of this report.

Following the tank excavation and removal in the boiler addition area, structural fill shall be used as backfill for the excavation. Structural fill should be placed to required grades in 8-inch thick maximum loose lifts, at the moisture content optimum for compaction, and compacted to at least 95 percent modified Proctor (ASTM D 1557) maximum dry density under footings and interior slabs and 90 percent density in the tank excavation, pavement and exterior slab areas. Dewatering of the excavation would be required prior to structural fill placement.

Stabilization of the tank excavation bottom can be accomplished with the placement of 12 to 18 inches of well-graded, 6-inch minus gravel with cobbles. Footing excavations should be stabilized, where necessary, with at least 6 to 12 inches of 6-inch minus, well-graded gravels with cobbles. Sufficient stabilization fill should be utilized so that proper compaction of the

overlying structural fill can be accomplished. Stabilization should be observed by the Geotechnical Engineer. Vibratory compaction should not be used.

Structural fill should consist of granular import material, free of organics and other deleterious materials. All imported fill should be approved by the Geotechnical Engineer for the project prior to its delivery to the site. In general, imported fill should contain no more than 20 percent fines (material passing the No. 200 sieve, based on the minus 3/4-inch fraction), should be well graded, and should have a maximum particle size of 3 inches. The plasticity index of the fines should not exceed 15 and the liquid limit should not exceed 35.

Utility trenches should be backfilled with compacted fill. Backfill material should be placed in lift thicknesses appropriate to the type of compaction equipment utilized and compacted to a minimum degree of compaction of 88 percent by mechanical means. In structural areas, that portion of the trench backfill within the structural area should conform to the material and compaction requirements of that area.

All site grading and fill operations should be observed by a representative from Delta Geotechnical Consultants, Inc., to determine the adequacy of site preparation, the suitability of fill materials, and compliance with compaction requirements. Further, the site should be inspected immediately after topsoil removal to possibly identify prior fill areas or unexpected soil conditions that may underlie the site.

The relative proximity of the existing boiler plant should be considered during the design and construction phases of this project. Vibrations induced by vibrating compactors may compact the foundation soils and adversely affect/crack the adjacent structure. Therefore, we

recommend that large vibratory compaction devices not be used in the tank excavation or footing areas. Furthermore, a preconstruction structural survey of adjacent structures may be a prudent precaution. Such a survey could reduce the potential for claims of structural damage caused by construction activities.

Vibratory rollers may be used in the proposed parking lot but should not be used directly over or within 15 feet adjacent to the steam tunnel connecting Whittier Elementary School and the Community College.

FOUNDATION RECOMMENDATIONS

Because of soft, compressible subsoil conditions, spread footings on structural fill are recommended for the proposed boiler plant addition. The following details should be observed:

1. Footings placed on structural fill could be designed for a maximum soil pressure of 1,500 pounds per square foot. This includes the total of dead load plus frequently applied live loads and may be increased by one-third for short-term transient wind and seismic loadings. We estimate maximum footing settlement under these pressures would be on the order of ¾ inch. The differential settlement between adjacent footings is expected to be about one-half the total settlement for similarly sized and loaded footings.
2. The depth of the compacted fill beneath the footings should be at least 4 feet or one-half the width of footing, whichever is greater.
3. Structural fill should extend a minimum one-half footing width or fill depth,

whichever is greater, outside the footing perimeter.

4. Continuous (wall) and individual (column) footings should be at least 16 and 24 inches wide, respectively, and should be placed a minimum of 2 feet below the lowest adjacent final grade.

5. Continuous foundation walls should be adequately reinforced both top and bottom. As a guide, we suggest an amount of steel equivalent to that required for a simply supported span of 15 feet.

6. Footings located adjacent to utility trenches or pipelines should have their bearing surfaces situated below an imaginary 1 to 1 plane projected upward from the bottom edge of the adjacent trench.

FLOOR SLABS

The interior floor slabs are recommended to be placed on a minimum of 12 inches of structural fill. Fill supporting floor slabs should be compacted to 95 percent of the maximum dry density as discussed previously. Six inches of free-draining gravel should be placed underneath the slabs to distribute floor loads and equalize moisture conditions. The slabs should be provided with frequent joints to minimize damage due to shrinkage cracking. Further, the slabs should be adequately reinforced for loading conditions utilized by the space. The slabs should be fully ground supported and separated from all bearing walls and partitions with a slip joint.

BACKFILL AROUND THE BUILDING

The on-site native silts and clay soils may be used as backfill around the building. The backfill should be free of organics and other deleterious materials and should be moistened, placed in maximum 6-inch loose lifts, and compacted to at least 88 percent of the maximum dry density as determined by ASTM D 1557. Use of vibratory or heavy compactors near the building should be restricted as discussed above under SITE PREPARATION AND GRADING.

SURFACE DRAINAGE

Adequate surface drainage must be maintained during the course of construction and after construction has been completed. The ground surface surrounding the exterior of the building should be sloped to drain away from the building in all directions. We recommend a minimum slope of 6 inches in the first 10 feet. Roof downspouts should discharge into splash blocks extended beyond the limits of all backfill. All sprinkler heads should be aimed away and kept at least 2 feet from the foundation walls. Landscaping requiring extensive watering should not be allowed within 4 feet of the building.

PAVEMENT DESIGN

We recommend a pavement section consisting of 3 inches of asphaltic concrete and 6 inches of high quality base material in the proposed parking area. Three and one-half (3.5) inches and 8 inches, respectively, are recommended in drives. This recommendation assumes the subgrade material below the base will consist of at least 12 inches of well-compacted

imported sand and/or gravel sand subbase and assumes low volume, light vehicular loading. Compaction of the subbase should be to a minimum of 90 percent of modified Proctor maximum dry density (ASTM D 1557).

The native subgrades at this site will likely become unstable from the activities of rubber-tired construction traffic if allowed to become wet or remain wet with current watering practices. The instability will take the form of rolling and possibly rutting under wheel loads and drum-type compactive devices. Every effort should be made to avoid exposing native subgrades to excess moisture. However, if unstable areas do develop, they can be stabilized with a well - graded, coarse-grained material or an appropriate construction fabric.

Stabilization may be achieved in the parking lot by placement of at least 16 inches of 6-inch minus rock fill placed in minimum thickness loose lifts of 12 inches. The parking lot area to be stabilized should first be overexcavated 6 inches prior to placement of stabilization fill. This fill should be densified with one to three passes of large construction equipment. Vibration should not be used. Additional lifts of rock may be necessary to achieve adequate stability.

As an alternate, a geofabric may be used for stabilization. The geofabric should meet or exceed the following minimum properties:

Grab Strength	ASTM D 1682	180 lbs.
Puncture Strength	ASTM D 3787-86	70 lbs.
Trapezoid Tear	ASTM D 4533	70 lbs.

A minimum of 12 inches of imported coarse structural fill should be placed above the geofabric. Again, the parking lot should be undercut 6 inches prior to placing the geofabric. The coarse imported fill should meet the following guideline specifications:

Sieve Size	Percent by Weight Passing
3 Inch	100
3/4 Inch	50 - 100
No. 4	30-70
No. 200	0-15

In either case, sand subbase should be placed to bottom of base elevation or the base should be extended to the stabilization fill and no subbase employed.

LIQUEFACTION HAZARD

As mentioned in our REGIONAL GEOLOGY AND TOPOGRAPHY, the site lies within a high liquefaction hazard area. To more accurately define the site specific hazards, additional test holes to at least 30 feet would be required.

CONSTRUCTION INSPECTION

All site grading and fill operations should be observed by a representative from Delta Geotechnical Consultants, Inc., to determine the adequacy of site preparation, removal of all unsuitable material, compliance with compaction requirements, and to insure that the

recommendations presented in this report are properly implemented during construction.

PLANS AND SPECIFICATIONS REVIEW

This report is based on the design of the proposed structure and loading conditions as they were submitted to Delta Geotechnical Consultants, Inc., at the commencement of the preparation of this report. It is recommended that the geotechnical engineer be provided the opportunity to review the final design and specifications in order to determine whether any change in concept may have had any affect on the validity of the geotechnical engineer's recommendations, and whether those recommendations have been properly implemented in the design and specifications. Review of the final design and specifications will be noted in writing by the geotechnical engineer.

LIMITATIONS

The analysis and recommendations submitted in this report are based upon the data obtained from five test holes drilled at the location of the proposed structure as indicated on Figure A-2. This report does not reflect any variations which may occur between the test holes. The nature and extent of variations may not become evident until the course of construction and are sometimes sufficient to necessitate changes in the designs; thus, it is important that we observe subsurface materials exposed in the excavations to take advantage of all opportunities to recognize differing conditions which would affect the performance of the facility being planned.

This report has been prepared in order to assist the architect and engineer in the design

of this project. In the event that any changes are planned in the design, location or elevation of the building as outlined in this report, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and conclusions of this report modified or approved in writing by the geotechnical engineer. We also recommend that final plans and specifications be reviewed by our office to evaluate whether our recommendations were properly understood and implemented.

The report should be available to prospective contractors for information on technical data only as interpreted from the test holes and not as a warranty of subsurface conditions.

DELTA GEOTECHNICAL CONSULTANTS, INC.

CURT A. STRIPEIKA
Field Engineer

LICENSED PROFESSIONAL ENGINEER
NO. 11915
GARY K. OLSON
STATE OF UTAH

Reviewed by:

GARY K. OLSON, P.E.
Senior Geotechnical Engineer

CAS-GKO/amh

REFERENCES

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Seiler, R.L. and Waddell, K.M., 1984, Reconnaissance of the shallow-unconfined aquifer in Salt Lake Valley, Utah: U.S. Geological Survey Water-Resources Investigation Report 83-4272, 34p.

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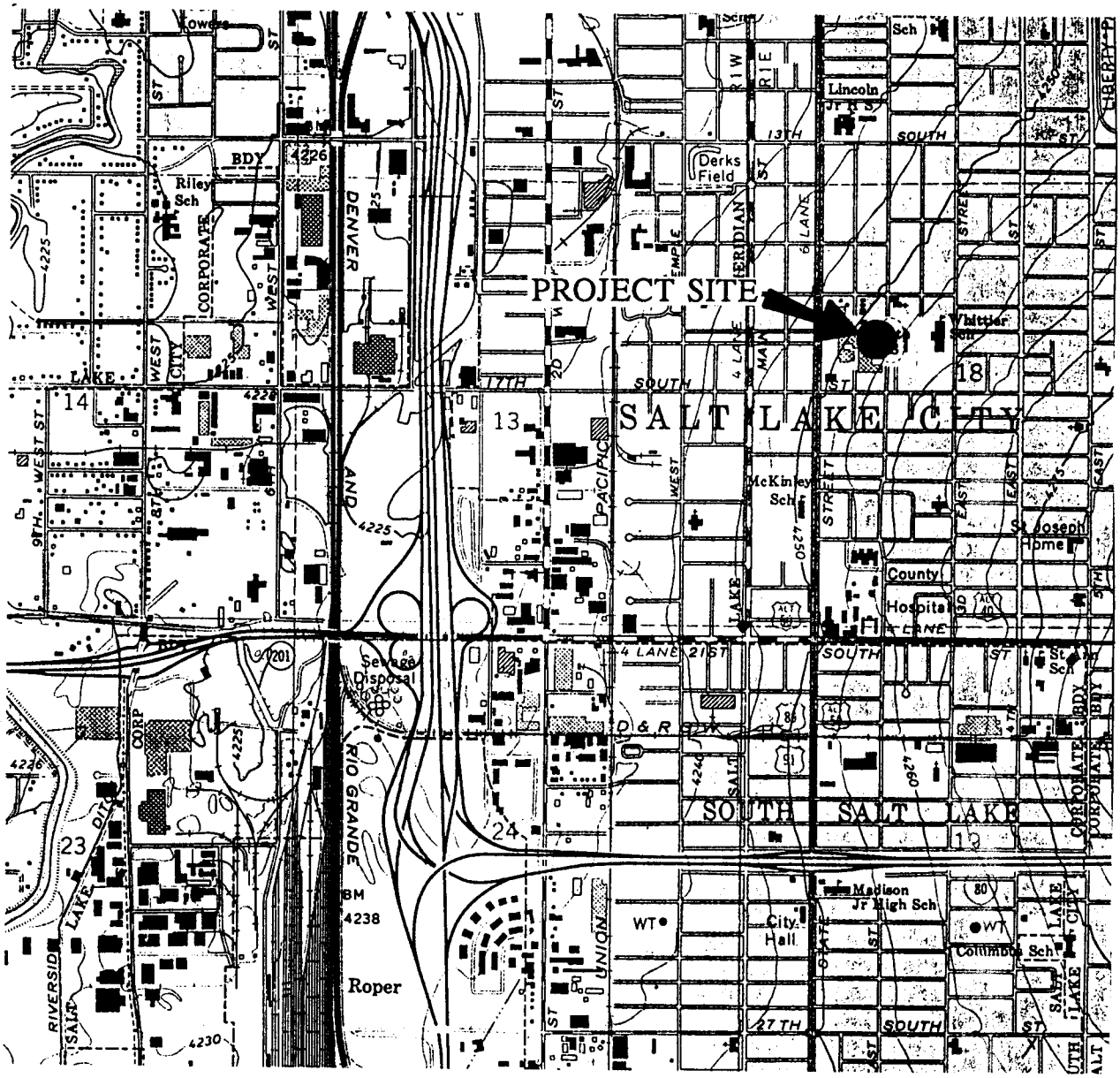
APPENDIX A

FIELD EXPLORATION, VICINITY MAP, SITE PLAN
AND LOGS OF TEST HOLES

FIELD EXPLORATION

Our field exploration consisted of the drilling, logging, and sampling of five 16.5-foot to 21.5-foot deep test holes. Locations of the test holes with respect to the proposed construction are shown on Figure A-2. Disturbed and undisturbed samples were taken at selected intervals, sealed and returned to our laboratory for classification and testing. A continuous log of the subsurface conditions as encountered in the test holes was kept during drilling. Drilling and sampling operations were performed by Earthcore of Salt Lake City, Utah. The test holes were logged by Curt Stripeika.

Delta
GEOTECHNICAL CONSULTANTS INC



VICINITY MAP

Reference: USGS 7.5 Minute South Salt Lake Quadrangle (Photorevised 1969 and 1975)

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FIGURE A-1

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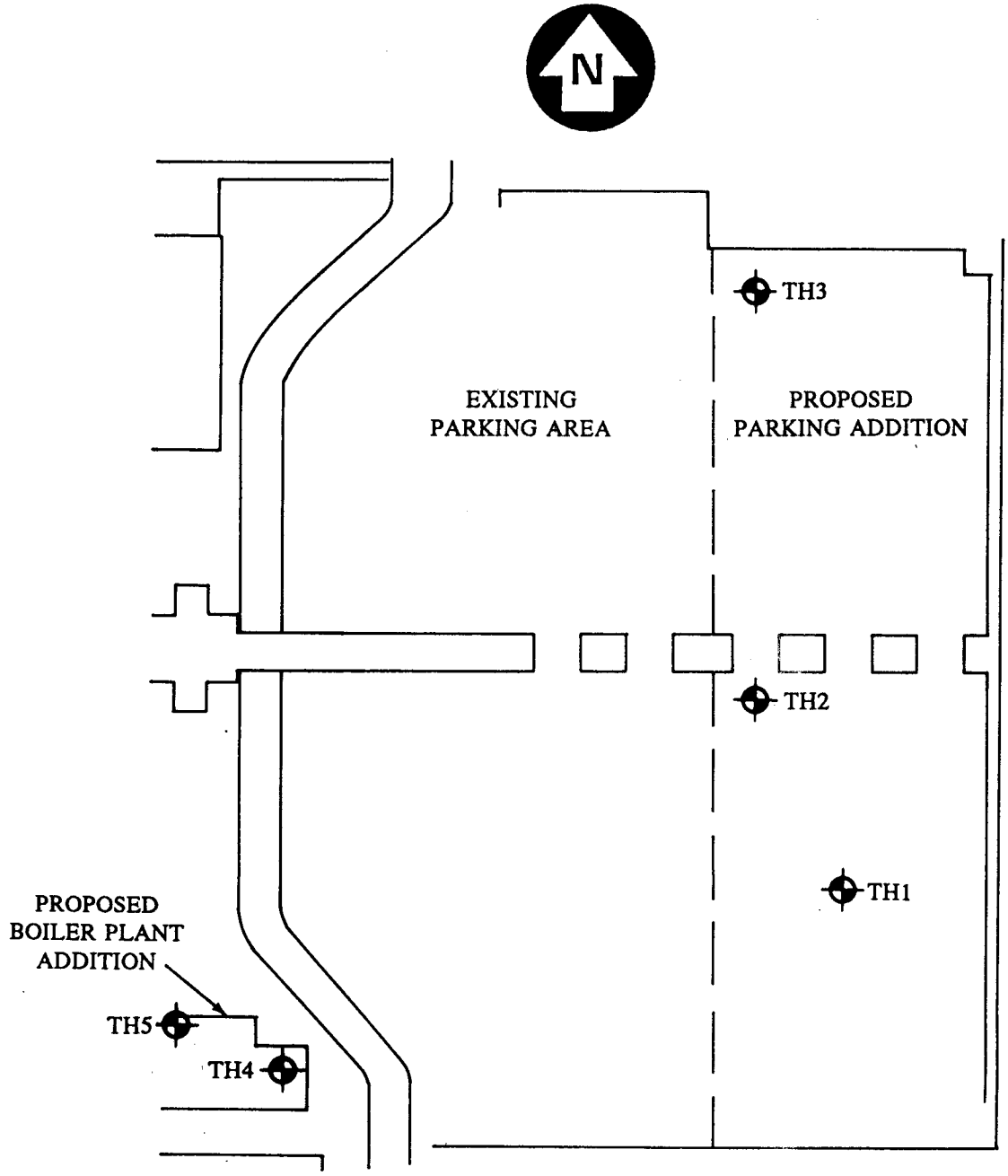
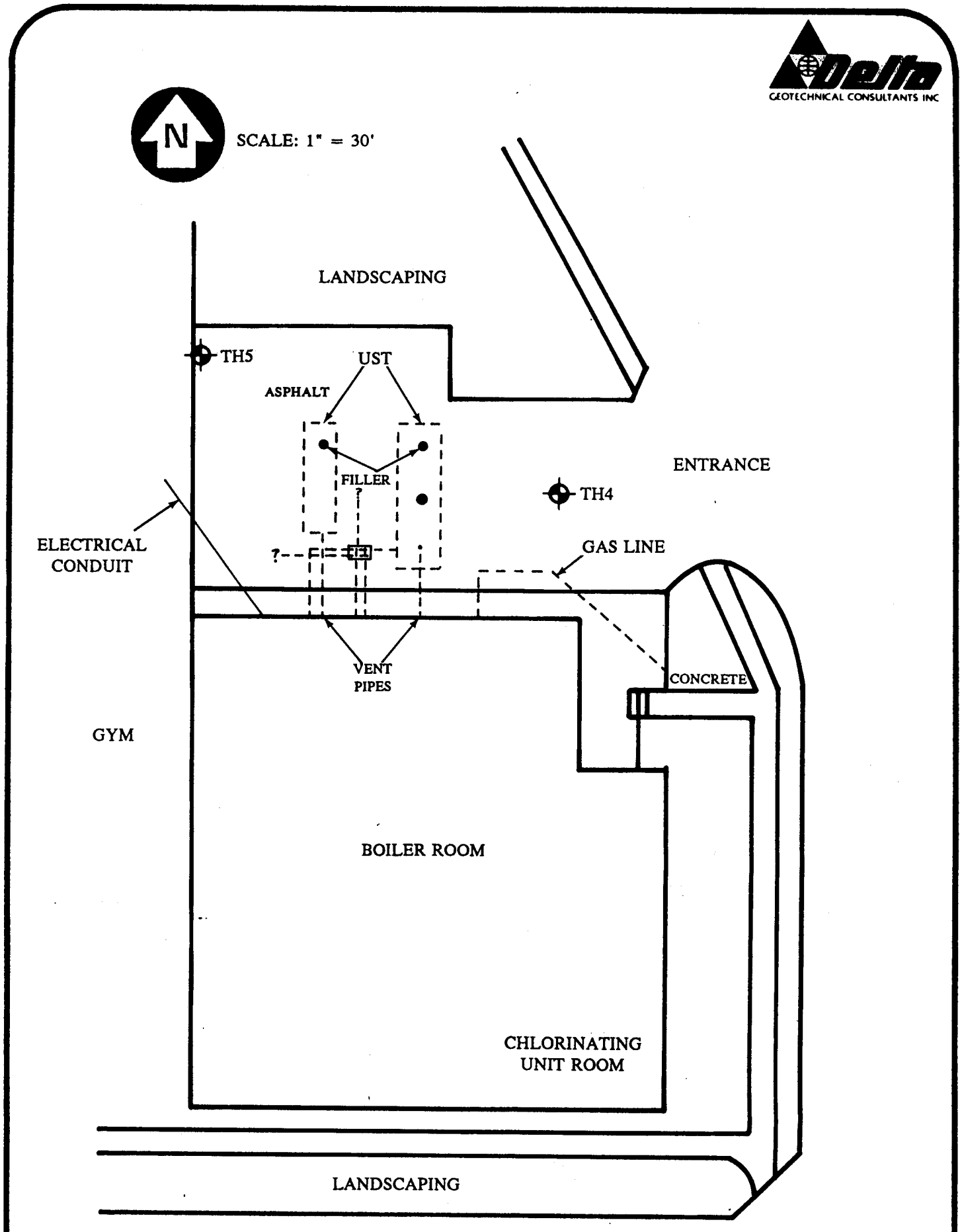


SITE PLAN SHOWING APPROXIMATE LOCATIONS
OF TEST HOLES

JOB NO. 3059

FIGURE A-2



SITE PLAN SHOWING PROPOSED
BOILER ADDITION

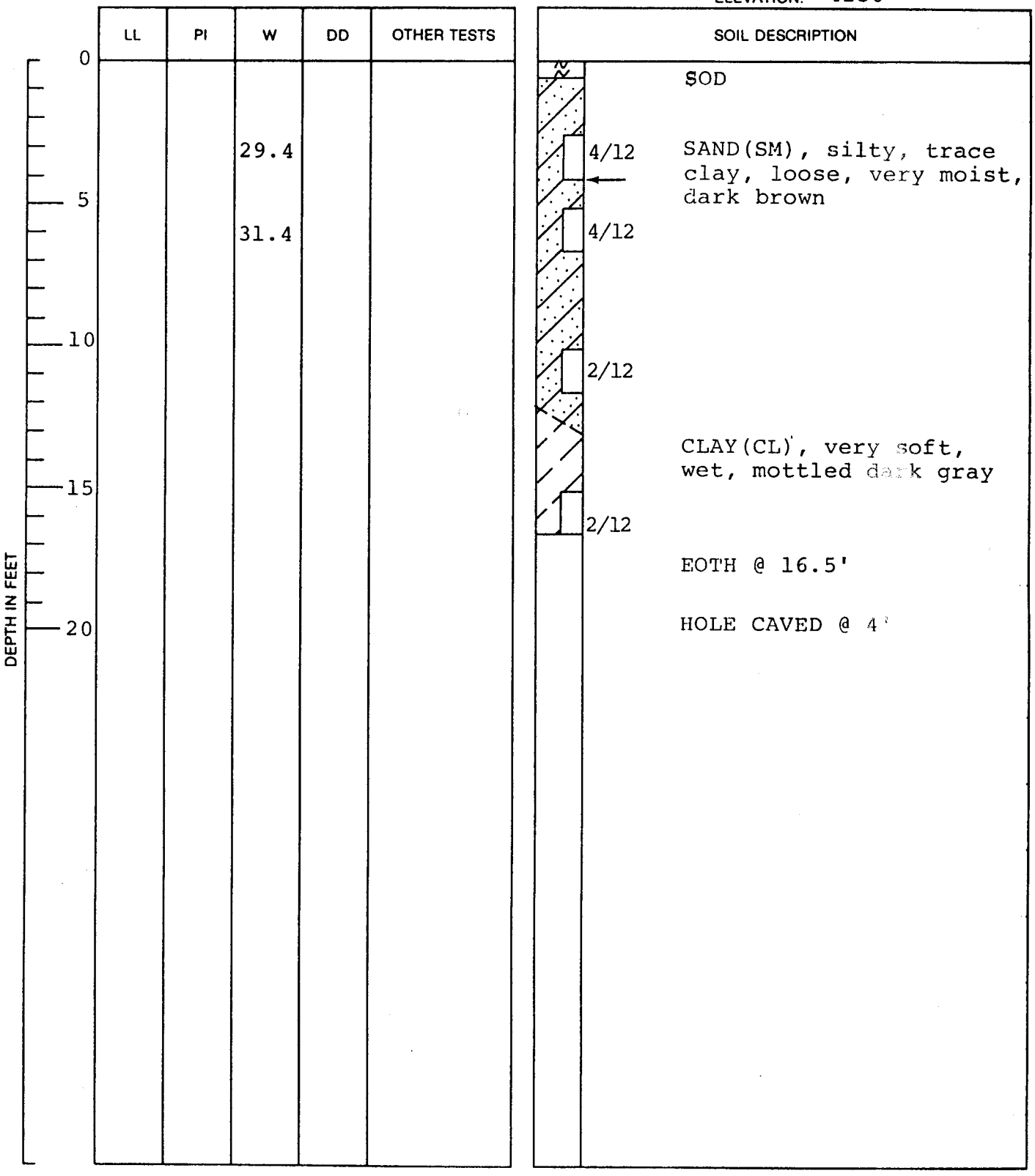
JOB NO. 3059

FIGURE A-3

Delta

TEST HOLE NO. 1

ELEVATION: 4256



LOG OF TEST HOLE

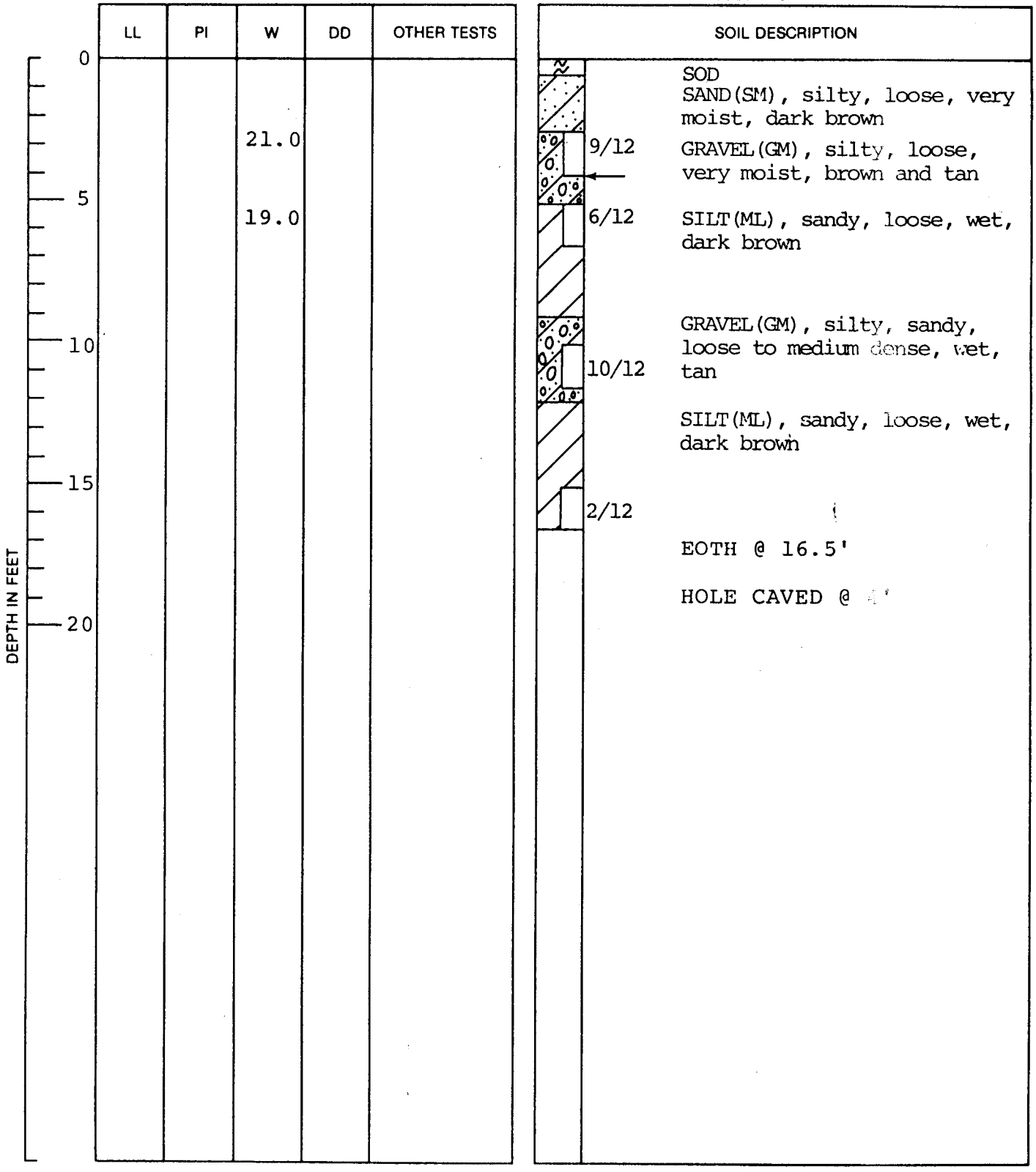
JOB NO. 3059

FIGURE A-4

Delta

TEST HOLE NO. 2

ELEVATION: 4255



LOG OF TEST HOLE

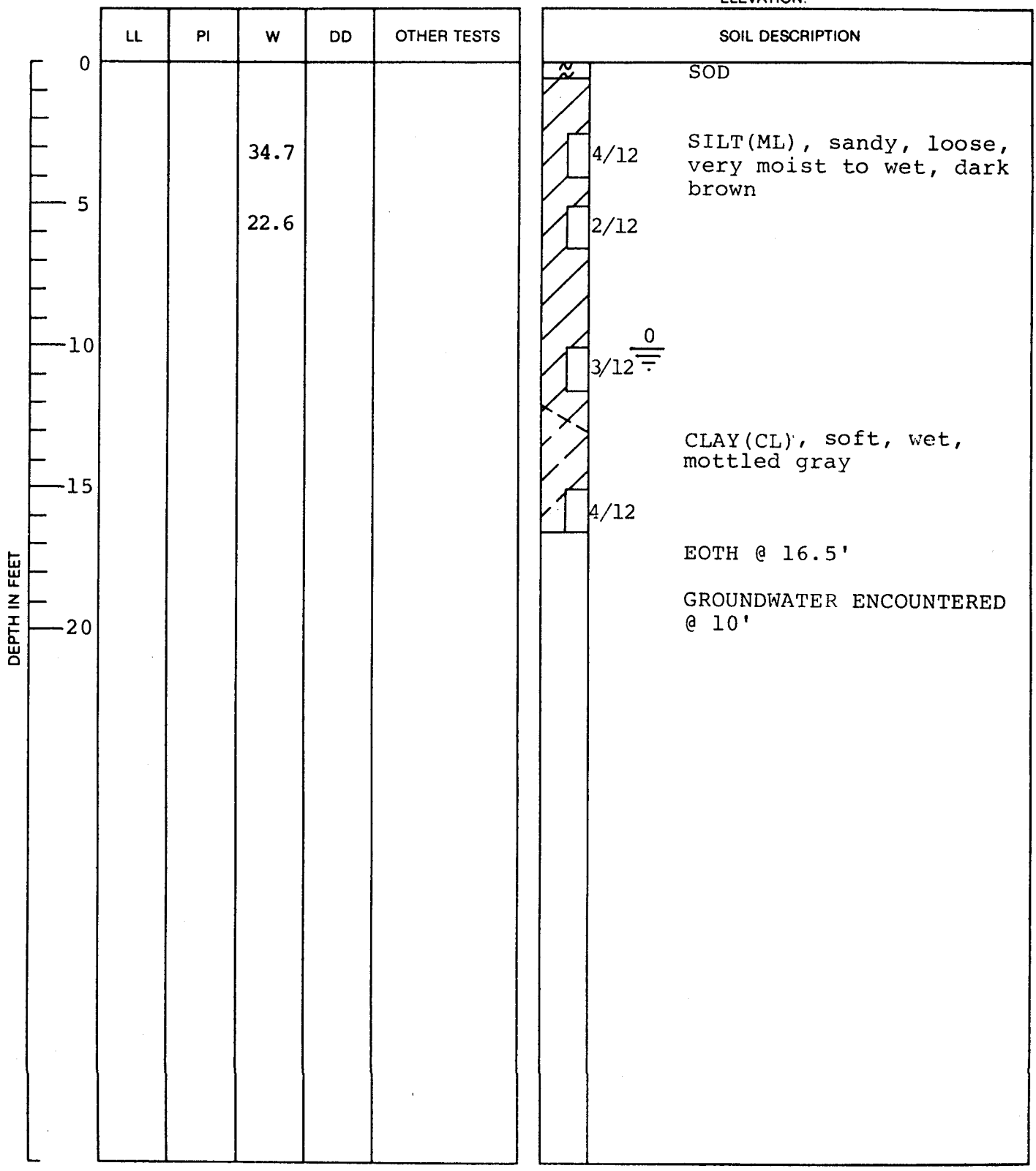
JOB NO. 3059

FIGURE A-5

Delta

TEST HOLE NO. 3

ELEVATION: 4254



LOG OF TEST HOLE

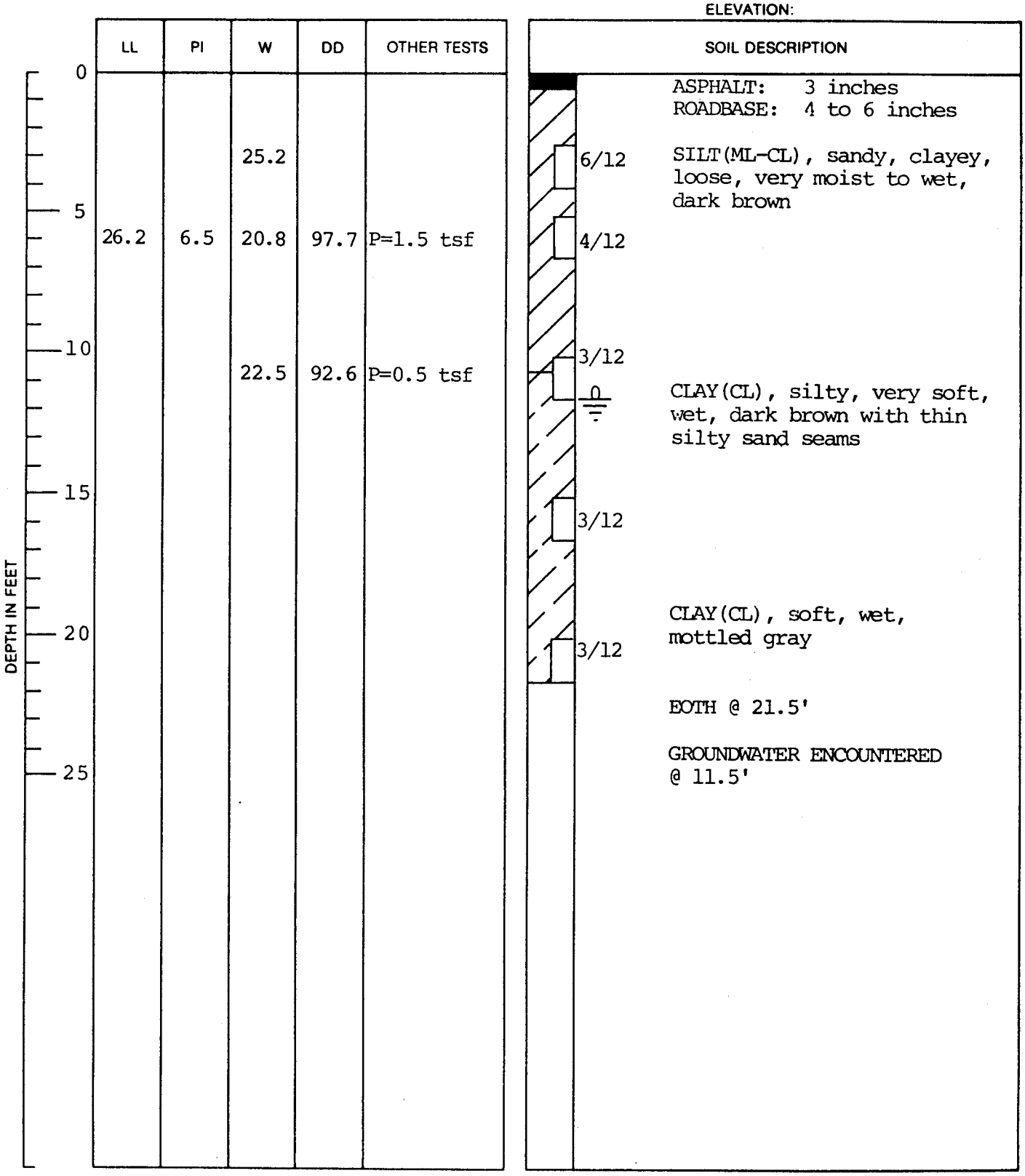
JOB NO. 3059

FIGURE A-6

Delta

TEST HOLE NO. 4

ELEVATION:



LOG OF TEST HOLE

JOB NO. 3059

FIGURE A-7

Delta

TEST HOLE NO. 5

ELEVATION:

DEPTH IN FEET	LL	PI	W	DD	OTHER TESTS	SOIL DESCRIPTION
0						ASPHALT: 3 inches ROADBASE: 4 to 6 inches
			29.2			2/12 SILT(ML), sandy, very loose, wet, dark brown
5			24.5			2/12
10						3/12 SAND(SM), silty, very loose, wet, light brown
						0 CLAY(CL), silty, soft, wet, brown with thin silty sand seams
15						3/12
20			41.4		P=1.0 tsf	3/12 CLAY(CL), soft, wet, mottled gray
25						EOTH @ 21.5' HOLE CAVED @ 5' GROUNDWATER ENCOUNTERED @ 12.5'

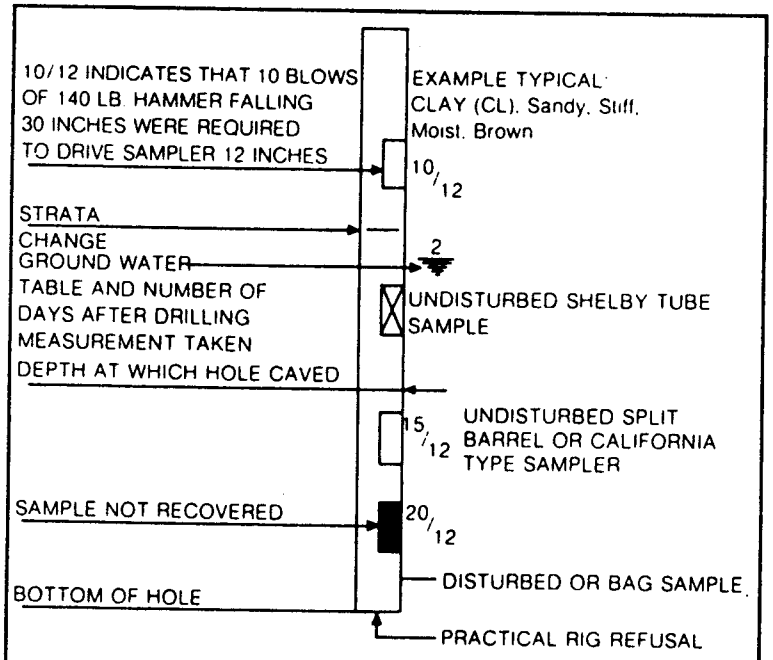
LOG OF TEST HOLE

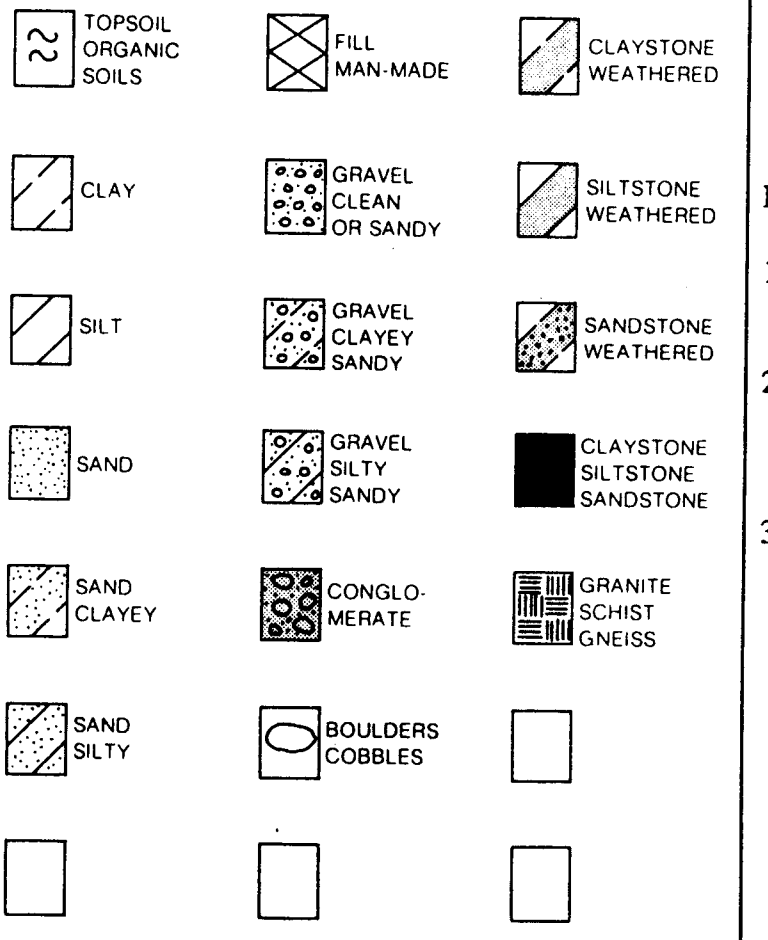
JOB NO. 3059

FIGURE A-8

Delta

KEY TO TEST HOLE





RELATIVE DENSITY (SAND & SILT)

VERY LOOSE	LESS THAN	4		BLOWS / FOOT
LOOSE	4	TO	10	BLOWS / FOOT
MEDIUM DENSE	10	TO	30	BLOWS / FOOT
DENSE	30	TO	50	BLOWS / FOOT
VERY DENSE	MORE THAN		50	BLOWS / FOOT

CONSISTENCY (CLAY)

VERY SOFT	LESS THAN	2		BLOWS / FOOT
SOFT	2	TO	4	BLOWS / FOOT
MEDIUM STIFF	4	TO	8	BLOWS / FOOT
STIFF	8	TO	15	BLOWS / FOOT
VERY STIFF	15	TO	30	BLOWS / FOOT
HARD	MORE THAN		30	BLOWS / FOOT

ABBREVIATIONS

LL - LIQUID LIMIT (%)
PI - PLASTIC INDEX
W - NATURAL MOISTURE CONTENT (%)
DD - DRY DENSITY (PCF)
NP - NONPLASTIC
-200 - PERCENT PASSING NO 200 SIEVE
UC - UNCONFINED COMPRESSION STRENGTH (PSF)
Ø - FRICTION ANGLE (DEGREES)
C - COHESION (PSF)
P - Hand Penetrometer (tsf)

NOTES:

1. The soils have been classified in accordance with the Unified Soil Classification System.
2. The test holes were drilled on May 20, 1993 with a truck-mounted, 6-inch diameter continuous flight power auger.
3. Free water was found to be about 10 to 12.5 feet below the existing ground surface during our field investigation.

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FIGURE A-9